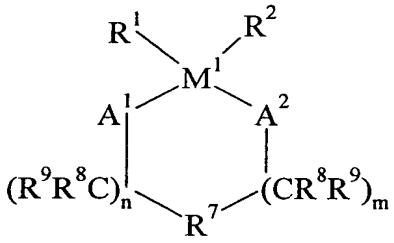
What is claimed is:

CLAIMS

1. A substantially amorphous poly(α-olefin) possessing a M_w of from about 500 to about 50,000, a M_w/M_n of from about 1.0 to about 10, a Kv_{100} of from about 10 to about 10,000, an iodine number of from about 0.0 to about 10, and a T_g of below about -60°C, obtained from the polymerization of at least one α-olefin having from 2 to about 20 carbon atoms and prepared by a process comprising polymerizing the monomer in the presence of hydrogen and a catalytically effective amount of a catalyst, wherein the catalyst comprises the product obtained by combining a metallocene catalyst with a cocatalyst, the metallocene catalyst being at least one *meso* compound of general formula:



(I)

wherein:

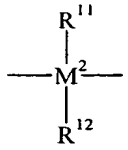
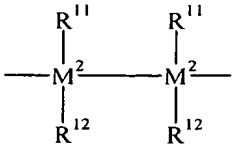
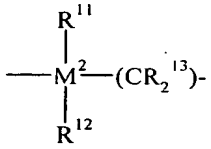
A^1 and A^2 are independently selected from the group consisting of mononuclear and polynuclear hydrocarbons;

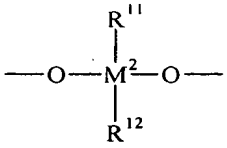
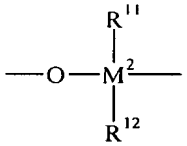
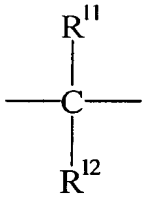
M^1 is a metal from group IVb, Vb, or VIb of the Periodic Table;

R^1 and R^2 are independently selected from the group consisting of hydrogen, C_1-C_{10} alkyl, C_1-C_{10} -alkoxy, C_6-C_{10} aryl, C_6-C_{10} aryloxy, C_2-C_{10} alkenyl, C_7-C_{40} arylalkyl, C_7-C_{40} alkylaryl, C_8-C_{40} arylalkenyl and halogen;

R^7 is selected from the group consisting of:

R^7 is selected from the group consisting of:

$=BR^{11}$, $=AlR^{11}$, -Ge-, -Sn-, -O-, -S-, $=SO$, $=SO_2$, $=NR^{11}$, $=CO$, $=PR^{11}$ and $=P(O)R^{11}$, where R^{11}, R^{12}, and R^{13} are independently selected from the group consisting of hydrogen, halogen, C_1-C_{10} alkyl, C_1-C_{10} fluoroalkyl, C_6-C_{10} aryl, C_6-C_{10} fluoroaryl, C_1-C_{10} alkoxy, C_2-C_{10} alkenyl, C_7-C_{40} arylalkyl, C_8-C_{40} arylalkenyl, and C_7-C_{40} alkylaryl, or, alternatively, R^{11} can be combined with R^{12} or R^{11} can be combined with R^{13}, in each case with the atoms connecting them, to form a ring; and M^2 is selected from the group consisting of silicon, germanium, and tin;

R^8 and R^9 are independently selected from the group consisting of hydrogen, halogen, C_1-C_{10} alkyl, C_1-C_{10} fluoroalkyl, C_6-C_{10} aryl, C_6-C_{10} fluoroaryl, C_1-C_{10} alkoxy, C_2-C_{10} alkenyl, C_7-C_{40} arylalkyl, C_8-C_{40} arylalkenyl, and C_7-C_{40} alkylaryl;

m and n are identical or different and are zero, 1, or 2, with m plus n being zero, 1 or 2.

2. The poly(α-olefin) of Claim 1 wherein the cocatalyst is an aluminoxane.

3. The poly(α-olefin) of Claim 2 wherein the metallocene catalyst is combined with hydrogen and the aluminoxane cocatalyst in any order thereof in the presence or absence of monomer.

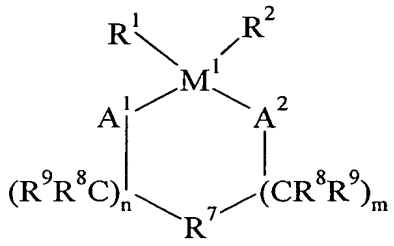
4. The poly(α-olefin) of claim 1 wherein the α-olefin is 1-decene.

5. The poly(α-olefin) of claim 1 wherein the metallocene catalyst based in terms of the transition metal M^1, is present in an amount from 0.0001 to about 0.02 millimole/liter and the cocatalyst is present in an amount from 0.01 to about 100 millimoles/liter.

6. The poly(α-olefin) of claim 1 wherein the catalyst is selected from the group consisting of *meso*-$Me_2Si(2\text{-Et-Ind})_2ZrCl_2$, *meso*-$Et(Ind)_2ZrCl_2$, *meso*-$Et(IndH_4)_2ZrCl_2$, *meso*-$Me_2Si(Ind)_2ZrCl_2$, *meso*-$Me_2Si(IndH_4)_2ZrCl_2$, *meso*-$Me_2Si(2\text{-Me-Ind})_2ZrCl_2$, and *meso*-$Me_2Si(2\text{-Me-4-Ph-Ind})_2ZrCl_2$.

7. A lubricant composition comprising a lubricant and a viscosity-modifying amount of a poly(α-olefin) wherein said poly(α-olefin) is substantially amorphous and possesses a M_w of from about 500 to about 50,000, a M_w/M_n of from about 1.0 to about 10, a Kv_{100} of from about 10 to about 10,000, an iodine number of from about 0.0 to about 10, and a T_g of below about -60°C, and said poly(α-olefin) is obtained from the polymerization of at least one α-olefin having from 2 to about 20 carbon atoms and prepared by a process

comprising polymerizing the monomer in the presence of hydrogen and a catalytically effective amount of a catalyst, wherein the catalyst comprises the product obtained by combining a metallocene catalyst with a cocatalyst, the metallocene catalyst being at least one *meso* compound of general formula:



(I)

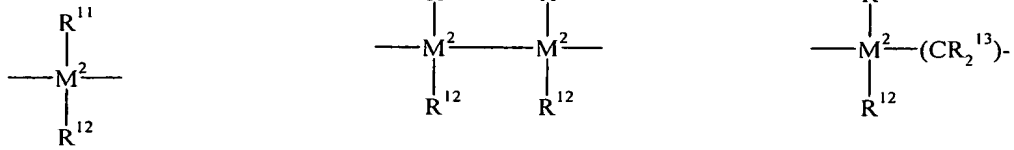
wherein:

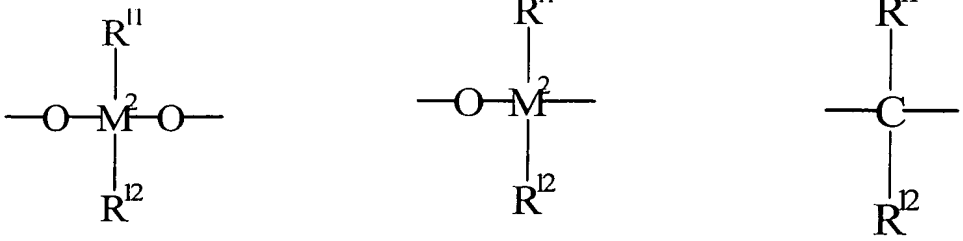
A^1 and A^2 are independently selected from the group consisting of mononuclear and polynuclear hydrocarbons;

M^1 is a metal from group IVb, Vb, or VIb of the Periodic Table;

R^1 and R^2 are independently selected from the group consisting of hydrogen, C_1-C_{10} alkyl, C_1-C_{10} -alkoxy, C_6-C_{10} aryl, C_6-C_{10} aryloxy, C_2-C_{10} alkenyl, C_7-C_{40} arylalkyl, C_7-C_{40} alkylaryl, C_8-C_{40} arylalkenyl and halogen;

R^7 is selected from the group consisting of:





=BR^{11}, =AlR^{11}, -Ge-, -Sn-, -O-, -S-, =SO, =SO_2, =NR^{11}, =CO, =PR^{11} and =$P(O)R^{11}$,

where

R^{11}, R^{12}, and R^{13} are independently selected from the group consisting of hydrogen, halogen, C_1-C_{10} alkyl, C_1-C_{10} fluoroalkyl, C_6-C_{10} aryl, C_6-C_{10} fluoroaryl, C_1-C_{10} alkoxy, C_2-C_{10} alkenyl, C_7-C_{40} arylalkyl, C_8-C_{40} arylalkenyl, and C_7-C_{40} alkylaryl, or, alternatively, R^{11} can be combined with R^{12} or R^{11} can be combined with R^{13}, in each case with the atoms connecting them, to form a ring; and M^2 is selected from the group consisting of silicon, germanium, and tin;

R^8 and R^9 are independently selected from the group consisting of hydrogen, halogen, C_1-C_{10} alkyl, C_1-C_{10} fluoroalkyl, C_6-C_{10} aryl, C_6-C_{10} fluoroaryl, C_1-C_{10} alkoxy, C_2-C_{10} alkenyl, C_7-C_{40} arylalkyl, C_8-C_{40} arylalkenyl, and C_7-C_{40} alkylaryl;

m and n are identical or different and are zero, 1, or 2, with m plus n being zero, 1 or 2.

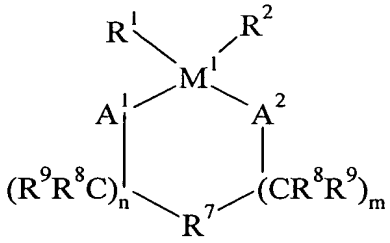
8. The lubricant composition of claim 7 wherein the α-olefin is 1-decene.

9. The lubricant composition of claim 7 wherein the metallocene catalyst based in terms of the transition metal M^1, is present in an amount from 0.0001 to about 0.02 millimole/liter and the cocatalyst is present in an amount from 0.01 to about 100 millimoles/liter.

10. The lubricant composition of claim 7 wherein the catalyst is selected from the group consisting of *meso*-$Me_2Si(2\text{-Et-Ind})_2ZrCl_2$, *meso*-$Et(Ind)_2ZrCl_2$, *meso*-$Et(IndH_4)_2ZrCl_2$, *meso*-$Me_2Si(Ind)_2ZrCl_2$, *meso*-$Me_2Si(IndH_4)_2ZrCl_2$, *meso*-$Me_2Si(2\text{-Me-Ind})_2ZrCl_2$, and *meso*-$Me_2Si(2\text{-Me-4-Ph-Ind})_2ZrCl_2$.

11. A method for improving the viscosity index of a lubricant composition comprising adding to the composition a viscosity-modifying amount of a poly(α-olefin) possessing a M_w of from about 500 to about 50,000, a M_w/M_n of from about 1.0 to about 10, a Kv_{100} of from about 10 to about 10,000, an iodine number of from about 0.0 to about 10, and a T_g of below about -60°C, wherein said poly(α-olefin) is substantially amorphous and is obtained from the polymerization of at least one α-olefin having from 2 to about 20 carbon atoms and prepared by a process comprising polymerizing the monomer in the presence of hydrogen and a catalytically effective amount of a catalyst, wherein the

catalyst comprises the product obtained by combining a metallocene catalyst with a cocatalyst, the metallocene catalyst being at least one *meso* compound of general formula:



(I)

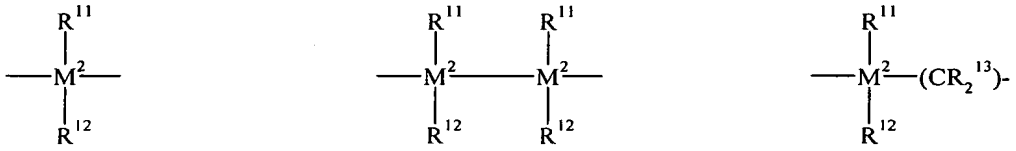
wherein:

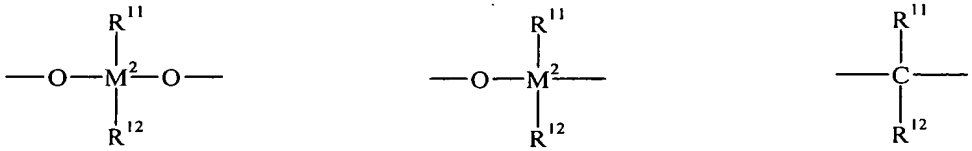
A^1 and A^2 are independently selected from the group consisting of mononuclear and polynuclear hydrocarbons;

M^1 is a metal from group IVb, Vb, or VIb of the Periodic Table;

R^1 and R^2 are independently selected from the group consisting of hydrogen, C_1-C_{10} alkyl, C_1-C_{10} -alkoxy, C_6-C_{10} aryl, C_6-C_{10} aryloxy, C_2-C_{10} alkenyl, C_7-C_{40} arylalkyl, C_7-C_{40} alkylaryl, C_8-C_{40} arylalkenyl and halogen;

R^7 is selected from the group consisting of:





=BR^{11}, =AlR^{11}, -Ge-, -Sn-, -O-, -S-, =SO, =SO_2, =NR^{11}, =CO, =PR^{11} and =P(O)R^{11},

where

R^{11}, R^{12}, and R^{13} are independently selected from the group consisting of hydrogen, halogen, C_1-C_{10} alkyl, C_1-C_{10} fluoroalkyl, C_6-C_{10} aryl, C_6-C_{10} fluoroaryl, C_1-C_{10} alkoxy, C_2-C_{10} alkenyl, C_7-C_{40} arylalkyl, C_8-C_{40} arylalkenyl, and C_7-C_{40} alkylaryl, or, alternatively, R^{11} can be combined with R^{12} or R^{11} can be combined with R^{13}, in each case with the atoms connecting them, to form a ring; and M^2 is selected from the group consisting of silicon, germanium, and tin;

R^8 and R^9 are independently selected from the group consisting of hydrogen, halogen, C_1-C_{10} alkyl, C_1-C_{10} fluoroalkyl, C_6-C_{10} aryl, C_6-C_{10} fluoroaryl, C_1-C_{10} alkoxy, C_2-C_{10} alkenyl, C_7-C_{40} arylalkyl, C_8-C_{40} arylalkenyl, and C_7-C_{40} alkylaryl;

m and n are identical or different and are zero, 1, or 2, with m plus n being zero, 1 or 2.

12. The method of claim 11 wherein the α-olefin is 1-decene.

13. The method of claim 11 wherein the metallocene catalyst based in terms of the transition metal M^1, is present in an amount from 0.0001 to about 0.02 millimole/liter and the cocatalyst is present in an amount from 0.01 to about 100 millimoles/liter.

14. The process of claim 11 wherein the catalyst is selected from the group consisting of *meso*-$Me_2Si(2\text{-Et-Ind})_2ZrCl_2$, *meso*-$Et(Ind)_2ZrCl_2$, *meso*-$Et(IndH_4)_2ZrCl_2$, *meso*-$Me_2Si(Ind)_2ZrCl_2$, *meso*-$Me_2Si(IndH_4)_2ZrCl_2$, *meso*-$Me_2Si(2\text{-Me-Ind})_2ZrCl_2$, and *meso*-$Me_2Si(2\text{-Me-4-Ph-Ind})_2ZrCl_2$.